

10 April 1967

Materiel Test Procedure 7-2-056
General Equipment Test Activity

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY ENGINEERING TEST PROCEDURE

SHELTERS - TENTS (AVIATION)

1. OBJECTIVE

The objective of this procedure is to provide test methodology and testing techniques necessary to determine the technical performance and safety characteristics of aviation maintenance tent shelters, and their associated tools and equipment, as described in QMR's and Technical Characteristics and to determine the items suitability for service tests.

2. BACKGROUND

A requirement exists for lightweight, adjustable, all-weather maintenance shelters, easily and readily transportable, for use in performing minor repairs on aircraft in the field. The tents are to be used in combat units and should afford adequate cover to personnel performing organizational maintenance on major components of Army aircraft.

Aircraft tents may be designed so that the aircraft may be placed completely within them, or they may be designed for nose-in maintenance of aircraft. For nose-in maintenance, the front end of each tent is provided with one or more nose-in walls designed so that only the front portion of the aircraft is placed within the tent, with the end wall fitted around the aircraft.

3. REQUIRED EQUIPMENT

Equipment as described in MTP 10-2-175 and the following:

- a. Air Compressor
- b. Appropriate Aircraft
- c. Simulated Nose-in section of an Appropriate Aircraft

4. REFERENCES

- A. Military Standard 810A (USAF), Environmental Test Methods,
23 June 1964
- B. USATECOM Regulation No. 385-6, Safety Regulation for USATECOM
- C. MTP 10-2-175, Tents and Shelters
- D. MTP 10-2-502, Durability and Reliability
- E. MTP 10-2-503, Transportability
- F. MTP 10-2-505, Human Factors
- G. MTP 10-4-001, Desert Environmental Test of General Supplies and Equipment
- H. MTP 10-4-002, Arctic Environmental Test of General Supplies and Equipment
- I. MTP 10-4-003, Tropic Environmental Test of General Supplies and Equipment

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5. SCOPE

5.1 SUMMARY

This MTP describes the following tests:

- a. Erection, moving and striking - A determination of time required to, and ease of, erecting, moving and striking the test item under varying soil and wind conditions with the tools and instructions supplied.
- b. Structural Stability Tests - A determination of the continuous winds and gusts, both natural and artificial, the test item can withstand without being damaged or blown down.
- c. Blackout Tests - A determination of the test item's ability to prevent light leakage.
- d. Illumination Tests - A determination of the light level in the test item under natural and artificial lighting conditions.
- e. Heating Tests - A determination of the test item's ability to obtain and maintain a "warm condition" within a reasonable amount of time and expenditure of fuel.
- f. Test Chamber Water Resistance Tests - A study to determine the test item's ability to prevent leakage under controlled conditions.
- g. Durability Tests - A study to determine the day by day and long range effects of rain, snow, wind, and sand or dust on the test item.
- h. Environmental Tests - A study to determine the effect of desert, arctic and tropic conditions on the test item.
- i. Maintainability - A study to determine the adequacy of the manufacturer's instructions, interchangeability of parts for repair, and causes for material and/or equipment deficiencies.
- j. Reliability - A study to determine the ability of the test item to perform, without excessive malfunctions, under normal conditions.
- k. Transportability - A study to determine the test item's ability to be carried by various types of carrier and/or personnel.
- l. Human Factors - A study to determine if the test item is constructed to be of the maximum benefit to personnel and cause them the least amount of fatigue, irritation, etc. within due military considerations.
- m. Safety - A study to determine that the test item does not contain any unwarranted hazards.

5.1 LIMITATIONS

This procedure is limited to nose-in wall tent and air inflated tents; it does not provide methods for testing special characteristics of aviation tents such as sound level, ventilation, etc., or general tents and shelters which are tested in MTP 10-2-175.

6. PROCEDURES

6.1 PREPARATION FOR TEST

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6.1.1 Arrival Inspection Tests

Arrival inspection tests shall be conducted as described in MTP 10-2-175.

6.1.2 Physical Characteristics

The test item's physical characteristics shall be determined as described in MTP 10-2-175.

6.2 TEST CONDUCT

NOTE:

1. During each phase of the test a minimum of three test items shall be used.
2. When testing nose-in wall aircraft, the test director shall insure that all the different applicable types of aircraft be used during the conduct of the test by changing the aircraft type for the various procedures.

6.2.1 Erection, Striking and Moving

NOTE: Erection and striking procedures shall be conducted under the wind, environmental and soil conditions described in MTP 10-2-175 when performing erection and striking tests.

6.2.1.1 Erection

6.2.1.1.1 Nose-In Wall Tents - Non-air inflated nose-in wall tents shall be erected as described in MTP 10-2-175 for each nose in wall positions.

6.2.1.1.2 Air-inflated Tents - Erect the test item, starting with the item packed for transport, as specified in the applicable instruction manual and record the following:

- a. Test Site wind velocity
- b. Difficulties encountered, as applicable:
 - 1) Unpacking the test item
 - 2) Preparing the blower mechanism
 - 3) Inflating the test item
 - 4) Anchoring the test item
 - 5) Installing accessory equipment
- c. Time required, as applicable:
 - 1) To unpack the item
 - 2) To prepare the blower mechanism
 - 3) To inflate the test item
 - 4) To anchor the test item

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- 5) To install accessory equipment
- 6) For complete assembly (start of unpacking to ready for use)
 - d. Accessory equipment installed
 - e. Adequacy of instruction manual
 - f. Adequacy of supplied tools
 - g. Additional required tools
 - h. Adequacy of training requirements

6.2.1.2 Striking

6.2.1.2.1 Nose-In Wall Tents - Non-air inflated nose-in wall tents shall be struck as described in MTP 10-2-175 for each nose-in wall position.

6.2.1.2.2 Air-Inflated Tents - Strike the test item, as specified in the applicable instruction manual and record the following:

- a. Test site wind velocity
- b. Difficulties encountered, as applicable:
 - 1) Removing accessory equipment
 - 2) Removing the anchoring
 - 3) Deflating the test item
 - 4) Disassembling the blower mechanism
 - 5) Packing the test item for transport
- c. Time required, as applicable:
 - 1) To remove accessory equipment
 - 2) To remove anchoring
 - 3) To deflate the test item
 - 4) To disassemble the blower mechanism
 - 5) To pack the test item for transport
 - 6) For complete striking (start of removal of accessory equipment to ready for transport)
- d. Adequacy of instruction manual

6.2.1.3 Moving: Air-Inflated Tents Only

With the test item erected on flat turf, with no precipitation, a maximum wind speed of 10 mph and moderate temperature, move the test item, as directed in the instruction manual, a minimum of 100 yards or twice the diameter or long axis of the tent, whichever is longer, and record the following:

- a. Distance the test item was moved
- b. Time required to move the test item
- c. Difficulties encountered in moving the test item
- d. Optimum crew size to move the test item
- e. Adequacy of the instruction manual

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6.2.1.3.1 Adverse Wind Conditions - Repeat paragraph 6.2.1.3. with a wind speed between 10 and 20 mph.

6.2.1.3.2 Adverse Soil Conditions - Repeat paragraph 6.2.1.3 and 6.2.1.3.1 with the following soil conditions:

- a. Sand
- b. Rock
- c. Bare

6.2.1.3.3 Adverse Environmental Conditions - Repeat paragraphs 6.2.1.3, 6.2.1.3.1 and 6.2.1.3.2; as applicable, under the following conditions:

- a. Moderate Temperature
 - 1) Rainfall on turf; sand
- b. Cold Temperature
 - 1) Snow on sand; bare soil
 - 2) Record handwear used.

6.2.2 Structural Stability Tests

6.2.2.1 Air-inflated and Nose-In Tents without Aircraft at an End Wall

Determine the winds that the test item can withstand without suffering damages by subjecting the test item to the applicable section of MTP 10-2-175.

6.2.2.2 Nose-In Tents with Aircraft

Determine the winds that nose-in tents can withstand, without suffering damage, while simulating/performing aircraft maintenance as follows:

NOTE: Motion pictures shall be taken to show the test item's performance under high winds.

6.2.2.2.1 Continuous Wind Tests - Determine the effects of a continuous wind as follows:

- a. Erect the test item under normal field conditions on flat turf.
- b. Insert the nose of an appropriate aircraft or simulated nose-in section of an appropriate aircraft into an end wall around the aircraft. Record the aircraft used and the difficulties encountered in properly inserting and covering the aircraft.
- c. Subject the aircraft and test item end wall to wind machine winds of 30 mph for 30 minutes. Record any damages incurred.
- d. If no damages occurred apply winds, in increments of 5 mph, for 30 minutes to the test item end wall of step c until damage has occurred. Record damage incurred, wind velocity and length of time wind was applied.

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e. Continue applying the damaging wind of step d for a total of two hours or until the test item has been blown down. Record the total amount of time the destructive wind was applied.

f. Repeat steps b through f with the test item erected in the following soil:

- 1) Sand
- 2) Rock
- 3) Bare

6.2.2.3 Air-Inflated Tents

Determine the length of time the test item can remain operational (inflated and rigid) after the blower has been turned off as follows:

- a. Erect the test item under normal conditions in flat turf.
- b. Turn off the air-blower and record the time.
- c. With the air-blower off record the following:
 - 1) Time of indication of loss of inflation
 - 2) Time at which the test item commences sagging
 - 3) Time at which the test item collapses

6.2.3 Blackout Tests

6.2.3.1 Air-Inflated Tents and Nose-In Tents Without Aircraft at an End Wall

Determine blackout conditions by subjecting the test items to the applicable section of MTP 10-2-175.

6.2.3.2 Nose-In Tents with Aircraft

Determine the ability of the test item to meet blackout conditions while simulating/performing aircraft maintenance as follows:

- a. Erect the test item under normal field conditions on an open grassy field with completely unobstructed view for a minimum of 250 yards from the tent.
- b. Mark off concentric circles of approximately 10, 20, 50, 100, 150, 200 and 250 yards from the test item.

On a moonless night perform the following, as applicable:

- 1) Insert the nose of an appropriate aircraft into an end wall position and fold the end wall around the aircraft. Record the aircraft used and the difficulties encountered in properly inserting and covering the aircraft.
- 2) Operate one 100-watt electric lamp, at rated wattage, in the center of the maintenance area.

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d. A minimum of one observer, with normal vision, shall traverse a circle ten yards from the tent and record all points of the tent and/or aircraft where leakage is observed.

NOTE: Leakage that can be eliminated without the use of special equipment (tighten of folds) shall be corrected.

e. Observation shall be made, and light leakages recorded from the following distance in the following order: 250 yards, 200 yards, 150 yards, 100 yards, 50 yards, and 20 yards.

6.2.4 Illumination Tests

The adequacy of natural and artificial light within test item shall be determined by performing the applicable portions of MTP 10-2-175.

6.2.5 Heating Tests

6.2.5.1 Air-Inflated Tents and Nose-In Tents Without Aircraft at an End Wall

Determine heating characteristics of the test item by subjecting the test item to the test preparation and conduct of the applicable section of MTP 10-2-175.

6.2.5.2 Nose-In Tents with Aircraft

Determine heating conditions of the test item while simulating/performing aircraft maintenance as follows:

6.2.5.2.1 Preparation for Test - Preparation for heating tests are as follows:

- a. Erect the test item under normal field conditions.
- b. Insert the nose of an appropriate aircraft into an end wall position and fold the end wall around the aircraft.
- c. Install the following instrumentation:

- 1) A hygro-thermograph in the center of the tent/maintenance area at a level equal to the center of the nose-in. Designate the thermograph as the thermometer position No.1 (measure and record the height of the nose-in).
- 2) Mercury-in-glass thermometers four feet above the ground and three feet from the sides of the tent, near the four corners of the tent

NOTE: Using the configuration of Appendix A, designate these thermometer positions as Nos. 2, 3, 4 and 5.

- 3) Shields thermocouples shall be suspended at the center of the tent/maintenance area at the following heights, as

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applicable; Floor level, 1, 2, 3, 4, 5 and 7 feet above the floor level; test item top.

d. Install the test items supplied heating system or an equivalent.

NOTE: Mount the heating system's fuel cans on scales to allow for weight measurements during testing.

6.2.5.2.2 Test Conduct - Perform the test conduct portion of the applicable section of MTP 10-2-175.

6.2.6 Test Chamber Water Resistance Tests

6.2.6.1 Air-Inflated Tents with and without Aircraft, and Nose-In Tents Without Aircraft at End Wall

Water resistance shall be determined by subjecting the test item to the applicable section of MTP 10-2-175.

6.2.6.2 Nose-In Tents with Aircraft

Determine water resistance of the test item, while simulating/performing aircraft maintenance, by performing the following procedure:

a. Erect the test item using manual field conditions, in a facility similar to the USAGETA static rain course.

NOTE: The USAGETA rain course covers an area of 36 feet by 50 feet. The course is capable of simulating any rain condition from a slight drizzle (1/10 of an inch of rain per hour) to a torrential downpour of 3 inches of rain per hour by means of high pressure showerheads projecting from parapets thirty feet above the course floor.

b. Insert the nose of an appropriate aircraft or simulated nose-in section of an appropriate aircraft into an end wall position and fold the end wall around the aircraft. Record type of aircraft.

c. Subject dry test items to a 5-hour period of rainfall at the rate of 1 inch per hour.

d. Inspect the test item each half-hour and record the location area of intensity of all leakage.

NOTE: Two observers working independently of each other shall make the half-hourly inspections.

NOTE 2: Fabric leakage, seam leakage and wicking of the sewing thread will be recorded separately.

NOTE 3: Intensity of leakage shall be noted as follows:

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- a) Negligible leakage - damp spots, barely noticeable
- b) Minor leakage - droplets forming on the fabric or at the seams and hanging there (no movement of water) which under ordinary circumstances will not impair the test item's intended military use
- c) Major leakage - water continually leaking and dropping off or running down the test item's inner surface which impairs the test item's intended military use

NOTE 4: Special emphasis will be given to the protection from leakage provided at nose-in wall.

- e. Retain the test items on the rain course until they are completely dry.
- f. Subject the dried test items to a 5-hour period of rainfall at the rate of 3 inches per hour.
- g. Repeat step d.

6.2.7 Durability

Durability tests shall be conducted as described in MTP 10-2-175 with and without aircraft maintenance being performed/simulated.

6.2.8 Environmental Tests

Environmental tests, under desert, arctic and tropic conditions shall be performed as described in MTP 10-4-001, MTP 10-4-002, and MTP 10-4-003 respectively.

NOTE: Special emphasis will be placed on the protection provided by nose-in walls for aircraft maintenance.

6.2.9 Maintainability

Maintainability of the test item shall be determined by following the procedures outlined in MTP 10-2-175.

6.2.10 Reliability

Reliability tests shall be conducted as described in MTP 10-2-502.

6.2.11 Transportability

Transportability tests shall be conducted as described in MTP 10-2-503.

6.2.12 Human Factors

Human factors tests and considerations shall be conducted and absorbed in MTP 10-2-505.

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6.2.13 Safety

Safety evaluation shall be determined as described in MTP 10-2-175.

6.3 TEST DATA

6.3.1 Arrival Inspection Tests

Record arrival inspection data collected as described in MTP 10-2-175.

6.3.2 Physical Characteristics

Record physical characteristics data collected as described in MTP 10-2-175.

6.3.3 Erection, Striking and Moving

6.3.3.1 Erection and Striking

6.3.3.1.1 Nose-In Wall Tents

Record erection data, for each nose-in wall position, collected as described in MTP 10-2-175.

6.3.3.1.2 Air-Inflated Tents

Record the following for test item:

- a. Type of tent (Nose-in wall, Air-inflated)
- b. Test item number (1, 2 or 3)
- c. Test site terrain (turf, sand, etc.)
- d. Test site temperature, in °F
- e. Test site weather condition (clear, rain, snow)
- f. Test site terrain condition (wet, frozen, dry, etc.)
- g. Handwear used (gloves, arctic mittens, none)
- h. For erection:
 - 1) Test site wind velocity, in mph
 - 2) Difficulties encountered, as applicable
 - a) Unpacking the test item
 - b) Preparing the blower mechanism
 - c) Inflating the test item
 - d) Anchoring the test item
 - e) Installing accessory equipment
 - 3) Time required in minutes, as applicable
 - a) To unpack the test item
 - b) To prepare the blower mechanism

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- c) To inflate the test item
- d) To anchor the test item
- e) To install the necessary equipment
- f) For complete assembly
- 4) Accessory equipment installed
- 5) Adequacy of instruction manual
- 6) Adequacy of supplied tools
- 7) Additional required tools
- 8) Adequacy of training requirements

i. For striking:

- 1) Test site wind velocity in mph
- 2) Difficulties encountered, as applicable
 - a) Removing accessory equipment
 - b) Removing the anchoring
 - c) Deflating the test item
 - d) Disassembling the blower mechanism
 - e) Packing the test item for transport
- 3) Time required in minutes, as applicable:
 - a) To remove accessory equipment
 - b) To remove anchoring
 - c) To deflate the test item
 - d) To disassemble the blower mechanism
 - e) To pack the test item for transport
 - f) For complete striking
- 4) Adequacy of instruction manual

6.3.3.2 Moving: Air-Inflated Tents Only

Record the following for each test item:

- a. Test item number (1, 2, or 3)
- b. Test site terrain (turf, sand, etc.)
- c. Test site temperature, in °F
- d. Test site weather condition (clear, rain, snow)
- e. Test site terrain condition (wet, frozen, dry, etc.)
- f. Handwear used (gloves, arctic mittens, none)
- g. Distance the test item was moved, in yards
- h. Time required to move the test item, in minutes
- i. Difficulties encountered in moving the test item
- j. Optimum crew size to move the test item
- k. Adequacy of the instruction manual

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6.3.4 Structural Stability Tests

6.3.4.1 Air-Inflated and Nose-In Tents without Aircraft at an End Wall

Record structural stability data collected as described in MTP 10-2-175.

6.3.4.2 Nose-In Tents with Aircraft

6.3.4.2.1 Continuous Wind Tests

Record the following for each end wall and soil condition:

- a. Tent number (1, 2 or 3)
- b. Type of soil test item is erected on (sand, rock, etc.)
- c. Aircraft inserted in end wall
- d. Difficulties encountered while inserting aircraft
- e. Damages incurred to test item's end wall when exposed to 30 mph winds
- f. When exposed to changes of wind in increments of 5 mph:
 - 1) Damages incurred to test item's end wall
 - 2) Wind velocity causing damage, in mph
 - 3) Length of time wind was applied
- g. Time required for blowdown, in minutes

6.3.4.3 Air-Inflated Tents

Record the following:

- a. Time air blower was turned off, in hours and minutes
- b. Time of indication of loss of inflation, in hours and minutes
- c. Time at which the test item commenced to sag, in hours and minutes
- d. Time test item collapsed, in hours and minutes

6.3.5 Blackout Tests

6.3.5.1 Air-Inflated Tents and Nose-In Tent without Aircraft at an End Wall

Data shall be recorded and collected as described in MTP 10-2-175.

6.3.5.2 Nose-In Tent with Aircraft

Record the following for each observation:

- a. Tent number (1, 2 or 3)
- b. Aircraft inserted in end wall
- c. Difficulties encountered while inserting aircraft

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- d. Light leakage points in tent
- e. Light leakage points in aircraft
- f. Maximum distance at which light can be observed (200 yds, 50 yds, etc.)

6.3.6 Illumination

Data shall be recorded and collected as described in MTP 10-2-175.

6.3.7 Heating Tests

6.3.7.1 Air-Inflated Tents and Nose-In Wall Tents without Aircraft at an End Wall

Data shall be recorded and collected as described in MTP 10-2-175.

6.3.7.2 Nose-In Tents with Aircraft

Record the following, as applicable:

- a. Tent number (1, 2 or 3)
- b. End wall used
- c. Type of aircraft used
- d. Data collected as described in MTP 10-2-175.

6.3.8 Test Chamber Water Resistance Tests

6.3.8.1 Air-Inflated Tents with/without Aircraft, and Nose-In Tents without Aircraft at End Wall

Record water resistance data collected as described in MTP 10-2-175.

6.3.8.2 Nose-In Tents with Aircraft

Record the following:

- a. Tent number (1, 2 or 3)
- b. Type of aircraft
- c. Test type (1 inch rain per hour, 3 inch rain per hour)
- d. Each half-hour during test for each observer

- 1) Observer number (1, 2)
- 2) Type leakage, location, and intensity of leakage, if any

a) Fabric leakage:

- (1) Location
- (2) Intensity (negligible, minor, major)

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- b) Seam leakage
 - (1) Location
 - (2) Intensity
- c) Wicking leakage
 - (1) Location
 - (2) Intensity

6.3.9 Durability

Record the following, as applicable:

- a. Tent under test (air-inflated, nose-in wall)
- b. Aircraft used (yes, no)
- c. Type of aircraft used
- d. End wall used
- e. Data collected as described in MTP 10-2-175

6.3.10 Environmental Tests

Data shall be recorded and collected as described in the following MTP's:

- a. For desert environments: MTP 10-4-001
- b. For arctic environments: MTP 10-4-002
- c. For tropic environments: MTP 10-4-003

6.3.11 Maintainability

Data shall be recorded and collected as described in MTP 10-2-175.

6.3.12 Reliability

Data shall be recorded and collected as described in MTP 10-2-502.

6.3.13 Transportability

Data shall be recorded and collected as described in MTP 10-2-503.

6.3.14 Human Factors

Data shall be recorded and collected as described in MTP 10-2-505.

6.3.15 Safety

Data shall be recorded and collected as described in MTP 10-2-175.

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6.4 DATA REDUCTION AND PRESENTATION

Data obtained for each performance characteristic will be summarized and evaluated for each tent tested. Appropriate charts and graphs will be used to summarize test data. Special consideration will be given to any condition or circumstance that may have contributed to any test result.

Time required to erect, move and strike each tent will be determined by averaging the times required by all crews of a given size. The size crew with the lowest average time will be recorded as the maximum size crew required to erect, move and strike the tent. The smallest crew that can successfully erect, move and strike the tent will be recorded as the minimum size crew. The optimum size crew will normally be between the minimum and maximum size crews. The optimum size crew will be determined by evaluation of the performance of individual crew members and by evaluation of the data for all crews. The optimum time required will be the average time required for the optimum size crew.

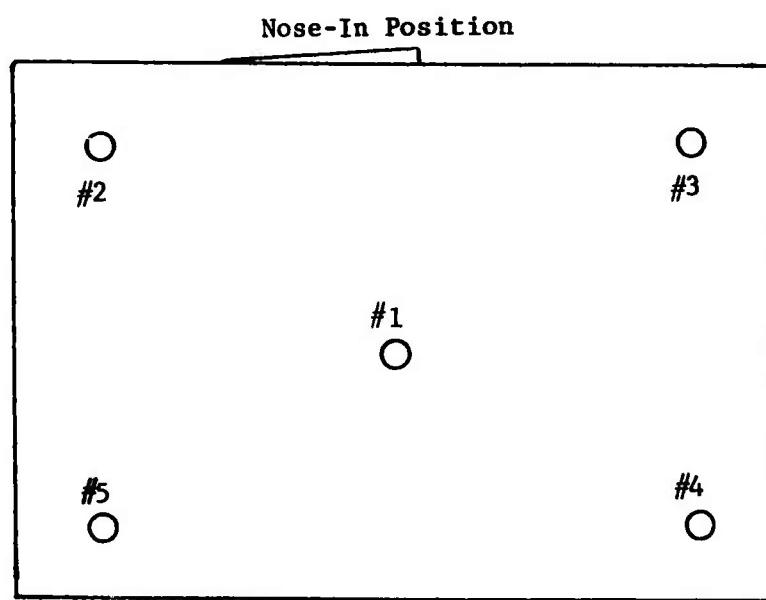
For illumination characteristics of each test tent, all 33 photometer readings made during each test will be averaged to determine the mean illuminosity for the tent.

For heating characteristics of each tent, all readings for each thermometer during each test period will be averaged. These mean temperatures for all thermometers will be averaged to determine the mean temperature of the tent during each three-hour test period. The mean temperature for all test periods will be averaged to determine the mean test temperature for the tent. Fuel consumption will be determined by differential weighing of fuel supply containers.

Data obtained for each performance characteristic will be compared with established performance standards for the tent, or data obtained for different types of tents undergoing the same test will be evaluated comparatively.

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APPENDIX A
SAMPLE LAYOUT SHOWING POSITIONS
FOR TEMPERATURE READINGS



NOTE: Position #1 will be located at the center of the nose-in.